



# HPTE

**Engineer's Report 2021**

**C470 – Segment 1**

# EXPRESS LINES

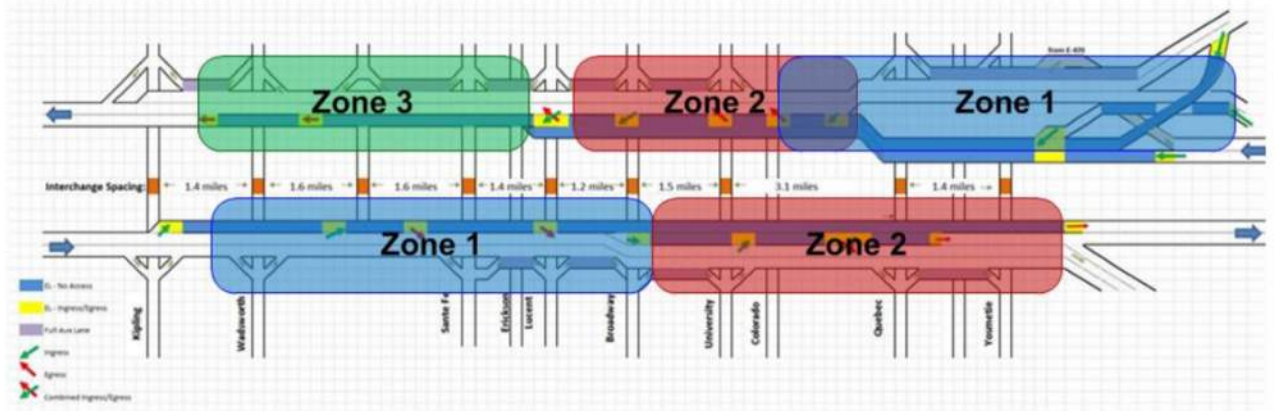


*Prepared for HPTE September 2021*

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## 1. Overview Map



### Toll Zone Designation – C470 Express Lanes

The above figure identifies the Tolling Zones and their limits within the corridor. Inspections and findings are organized around these five toll zones, three westbound and two eastbound. Our structure review including bridge and sign structures are included as a separate section.

## **2.0 Introduction and Methodology**

### **2.1 Introduction**

The Colorado High Performance Transportation Enterprise (HPTE) is required to perform an annual engineering review and develop a report that assess the condition of their Tolled Express Lane facilities. For the 2021 C-470 Express Lane Engineer's Report, [REDACTED] was retained to perform and prepare the Engineer's Report.

The contents of this report will review and recommend correction of any identified deficiencies for the C470 Tolled Express Lane (Segment 1). The general limits of this facility are from the E470 Tollway and I-25 on the east and extends west approximately 12 miles to Wadsworth Boulevard where the current Express Lane is either added or merges with the general-purpose lanes. The C470 Express Lane is separated from the general-purpose lanes by a four-foot painted buffer. From I-25 and E470 there are direct connect ramps to the west bound express lanes and along the length there are specific ingress/egress to accommodate interchange access to major cross streets along C470.

The project that completed improvements to C-470, which added the new express lanes, was accepted by CDOT in November of 2020. However, the Express Lane had completed its testing and officially began toll collection in August of 2020. Therefore, this review and assessment is being completed on a facility that has been, fully in service, for just over 1-year. In addition, there are ongoing Contractor responsibilities associated with the Design-Build Construction Contract. As part of the Contract there is a One Year Warranty and additional Landscape establishment and warranty elements that will need to be completed and will be noted as part of our review if appropriate.

As part of that engineer's report specific deficiencies, recommendations, and cost estimates have been prepared to inform corrective actions for consideration by HPTE. In addition, this annual engineer's report will assess and make recommendations for consideration as part of a six-year planning horizon and be included as a section in the report. This assessment only considered the express lane elements and did not include items beyond or associated with the general-purpose lanes or generally the north or south sides of C470.

### **2.2 Methodology**

The inspections of the express lane took place in August and early September of 2021. Inspections did not involve any lane closures. [REDACTED] utilized two Engineers to conduct the review, with one being a structural engineer. For safety, all inspections were conducted during daylight, weekday, and off-peak hours. Multiple passes, full length, through the express lanes were conducted and there was overlap between inspectors and areas covered.

When required or to note and document specific items the twelve foot inside shoulder was utilized to park and further investigate items in question. The inspections focused on two major categories of items: Roadway Elements and Roadside Elements.

Under **Roadway Elements** five subcategories were reviewed:

- Signing, striping, and tolling devices
- Guardrail and Median Barrier
- Pavement Condition
- Drainage Inlets
- Bridge Structures

Under **Roadside Elements** three subcategories were reviewed:

- Vegetation
- Delineators and shoulder drop-off condition
- Median infield inlets

Our engineer findings and recommendations are discussed in the following sections and are organized by Toll Zone and specific direction of travel. Specific deficiencies will be noted if no deficiencies were found a representative sample of findings will be included. For each Toll Zone and reviewed subcategory our findings will be summarized as “No Deficiency Noted” or will identify and detail the specific deficiency. For any of these noted deficiencies, in Section 4, of this report a Cost Estimate was prepared estimating the cost to correct.

The summary review of the various structures on the project is summarized in Section 3.6. This review and summary included bridge and sign structures and included any noted deficiencies.

The cost estimate will include appropriate bid item identification, an estimated quantity, and a unit price. The most recent CDOT Bid Data will be used to estimate a reasonable item cost. The estimate will note any special considerations or assumptions used in the estimate. A 20% contingency will generally be included, along with a design fee, and typical CE and indirect rate. The cost estimate may or may not reflect an actual cost but is intended to be a conservative estimate to repair or correct the noted deficiencies. Since all noted deficiencies were relatively minor and were typical across the various Toll Zones, a single cost estimate was prepared for all noted deficiencies and is included in Section 4.

For the six-year plan, general recommendations will be made for routine maintenance type items or elements that should be reviewed or could reach the end of their expected service life within that time frame. A cost estimate was prepared for those items or elements of work and are summarized in a 6-year Plan of Investments, by State Fiscal Year.

## 3.0 Observations

### Introduction

The following sections summarize findings and observations for the reviewed elements within the Five Toll Zones. The findings for the various structure elements have been summarized in a separate section and have not been organized around the specific Toll Zones. Noted structure deficiencies have been highlighted by structure number and/or structure crossing feature.

### Summary of findings

As expected for the review of a new facility all findings were relatively minor and no deficiency severely impacts the purpose or operation of the C470 Express Lanes. Generally, the deficiency findings have been summarized in three general categories and are discussed below:

- Minor Maintenance
  - **Cleaning inlets** – Most inlets observed on the project were clean and would function as designed. Through the review five inlets were noted as to need some additional cleaning. Inlet condition can change after any significant storm events, there was evidence that inlets had been cleaned and were free of debris.
  - **Sweeping** – Similar to inlets sediment was noted at several locations along median barrier and would be beneficial to sweep and remove this sediment prior to entering the storm sewer system.
  - A schedule may be developed for ongoing cleaning and sweeping, potentially consider this during spring after winter sanding operations and fall after major summer storm events.
- Seeding and Mulching
  - **Reseeding and Mulching** the median areas along the express lane does need work. This item is still part of ongoing landscape maintenance and warranty of the construction project and should be corrected as part of the project. A cost estimate to accomplish this work was included but should not be the responsibility of HPTE.
- Minor Structure Repair
  - At five Sign Bases tied into the median barrier minor cracking was observed. It was noted this cracking should be repaired with an **Epoxy Resin** to avoid concrete spalling during freeze/thaw cycles.
  - It was noted that **embankment material** has eroded around several sign bases. This is a minor condition and is a condition of the overall erosion occurring within the median areas and should be corrected as part of the reseeding and mulching.
  - The **concrete slope paving** at the Acres Green has cracked and warrants repair.

A cost estimate was prepared for the above deficiencies and is included in Section 4.

### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway

#### Roadway Elements

#### Signing, Striping, and Tolling Devices

##### Signing

All signs were found to be uniform in placement, consistent configuration, and in good condition. There were 12 Mono Tube signs, 10 standard steel post signs.



*Typical Monotube Overhead Signing, Good Condition*



*Typical Post Sign, Good Condition*

### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)

#### Striping

There are various types of striping and pavement markings observed to be in good and reasonable condition. Striping includes solid double white lines as the express lane buffer, yellow shoulder stripe, white skips, and white transition tapers. Pavement markings include white directional arrows and white “EXPRESS” designation in the express lane. Note the Mono Tube sign complementing the express lane designation.



*Typical Striping and Express Lane Marking, Good Condition*

#### Tolling Devices

Tolling devices were placed on Mono Tube sign as depicted in the attached picture. License plate camera installed on metal post attached to concrete barrier.



*Typical Tolling Device, Good Condition*



### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)

#### Guardrail and Barrier Conditions

Three barrier types are in use on C470 adjacent to the express lane: Type 3 Guardrail, TL4 Cable Barrier, and Type 7 Concrete Barrier. The Barriers purpose is to separate travel directions, protect MT Sign installations, and transition to bridge structures. All barriers are in good condition. Tire marks were observed on Type 7 barrier but no structural damage or adverse effect to the barriers function. Some erosion was noted at signpost bases.



*Typical Barrier Installation, Condition Good*

### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)

#### Pavement Condition

Concrete pavement is in good condition with two observations. There are areas where temporary pavement markings were ground off, this is common for phased construction as occurred on C470. A second observation, located east of Santa Fe, is a minor longitude crack and exposed aggregate indicative of spalling concrete. Treatment will be crack sealing and application of an epoxy coat. Neither repair is an urgent need or out of the ordinary maintenance for concrete pavement.



*Typical Pavement, Condition Good*

**3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)**

**Drainage Appurtenances/Shoulder Inlets**

Type C inlets were observed in good condition. Areas do show need of routine sweeping, and vacuum of inlet box. No lack of maintenance is evident. (eb 8)



*Typical Median Inlets, Good Condition*

### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)

## Roadside Elements

### Vegetation

Median vegetation ranged from good to poor. Observations ranged from grass established with some weeds, weeds evident, erosion blanket exposed and some minor rills. As a project within the warranty period and landscaping maintenance establishment still being monitored this is not unusual.



*Typical Roadside Vegetation, Requires Re-seeding*

**3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)**

**Roadside Delineation and Shouldering**

Delineation was in good condition and consistently placed. Shoulder in good condition, no drops from edge of pavement. (eb 11)



*Typical Roadside Shouldering and Delineation, Good Condition*

### 3.1 East Bound – Toll Zone 1 – Wadsworth to Broadway (Cont.)

#### Drainage and Median Inlets

Median drainage in fair condition, inlets are in good condition. Some rills or erosion of the flow lines observed. Some debris settled on inlet aprons. (eb 26)



*Typical Median Inlet, Requires Minor Maintenance*

## 3.2 East Bound – Toll Zone 2 – Broadway to I-25

### Roadway Elements

#### Signing, Striping, and Tolling Devices

##### Signing

All signs were found to be uniform in placement, consistent configuration, and in good condition. There were 14 Mono Tube signs, 13 standard steel post signs.



*Typical Steel Signpost, Good Condition*

### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Striping

There are various types of striping and pavement markings observed to be in good reasonable condition. Striping includes solid double white lines, yellow shoulder stripe, white skips, and white transition tapers. Pavement markings include white directional arrows and white “EXPRESS” designation in the express lane.



*Typical Express Lane Marking, Good Condition*



### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Tolling Devices

Tolling devices were placed on Mono Tube sign as depicted in the attached picture. License plate camera installed on metal post attached to concrete barrier.



*Typical Tolling Devices, Good Condition*

### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Guardrail and Barrier Conditions

Three barrier types are in use on C470 adjacent to the express lane: Type 3 Guardrail, TL4 Cable Barrier, and Type 7 Concrete Barrier. The Barriers purpose is to separate travel directions, protect MT Sign installations, and transition to bridge structures. All barriers are in good condition. Paint on the barrier or applied curing compound showed roadside wear or thin application.



*Typical Median Barrier, Good Condition*

**3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)**

**Pavement Condition**

Concrete pavement is in good condition.



*Typical Pavement, Good Condition*

### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Drainage Appurtenances/Shoulder Inlets

Type C inlet observed in good condition. Areas do show need of routine sweeping, and vacuum of inlet box. Note CSP monitoring toll lane for eastbound travel.



*Typical Median Inlet, Requires Sweeping Sediment Removal*

### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Roadside Elements

##### Vegetation

Median vegetation ranged from fair to good. Some sediment is evident but good grass growth in much of this segment.



*Typical Vegetation, Generally Good Condition*

### 3.2 East Bound – Toll Zone 2 – Broadway to I-25 (Cont.)

#### Roadside Delineation and Shouldering

Delineation was in good condition and consistently placed. Shoulder in good condition, no drops from edge of pavement. Barrier reflectors (green & yellow) with good reflectivity.



*Typical Delineation, Good Condition and Reflectivity*

#### Drainage and Median Inlets

Median drainage in fair to good condition. Will need mowing and some debris cleanup.



*Typical Median Inlet, Generally Good Condition*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec

#### Roadway Elements

##### Signing, Striping, and Tolling Devices

###### Signing

All signs were found to be uniform in placement, consistent configuration, and in good condition. Entry into Zone 1 begins with Mono tube signs along I-25, either direction, indicating Express Toll Lanes for C470. Two post mounted signs noting express lanes merging. There are six Monotube signs and 4 signs on posts.



*Typical Monotube sign, good condition, entrance to west bound Express Lanes*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Striping

C470 WB Zone 1 begins with two express lanes to accommodate I-25 and E470 travel. All striping and pavement markings observed to be in good and reasonable condition. Striping includes solid double white lines, yellow shoulder stripe, white and black inlaid skips, and white transition tapers. Pavement markings white directional arrows and white “EXPRESS” designation in each express lane.



*Typical Striping and pavement markings, Good condition.*



### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Tolling Devices

Tolling devices were placed on Monotube sign as depicted in the attached picture.



*Typical Cameras and license plate devices over double express lanes, Good Condition*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Guardrail and Barrier Conditions

Two barrier types were observed, Type 7 concrete barrier and Type 3 Guardrail. All barriers appeared good condition. Type 7 barrier had tire marks, no structural damage. One section note with a horizontal crack, still functions. Crack sealing recommended at reasonable maintenance interval.



*Type 7 barrier in good condition. Note tire marks and crack for repair*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Pavement Condition

Concrete pavement is in good condition. No deficiencies noted.



*Concrete pavement in good condition. Temporary striping removal evident, no issue.*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Drainage Appurtenances/Shoulder Inlets

Shoulder inlets were observed in good condition. Some debris pictured to cleaned during routine maintenance.



*Typical Inlet and apron, Good condition, Required routine maintenance for trash and debris*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Roadside Elements

##### Vegetation

No median vegetation. Paved shoulders and concrete barrier separating C470 travel directions throughout West Bound Toll Zone 1.



*Typical Median, Barrier separated in WB zone 1*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Roadside Delineation and Shouldering

Delineation was in good condition and consistently placed. Note reflectors on Type 7 barrier. Shoulder paved with HBP, good condition. Needs sweeping as part of routine maintenance.



*Typical Delineation on Type 7 barrier and bridge rail, Good condition*

### 3.3 West Bound - Toll Zone 1 – E470/I-25 to Quebec (Cont.)

#### Drainage and Median Inlets

Median drainage in good condition, inlets are in good condition.



*Typical median inlet in good condition*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway

#### Roadway Elements

##### Signing, Striping, and Tolling Devices

###### Signing

All signs were found to be uniform in placement, consistent configuration, and in good condition. There were 4 Mono Tube signs, 4 standard steel post signs.



*Typical Monotube Overhead Signing, Good Condition*



### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Striping

C470 WB Zone transition from two express lanes to a single express lane west of University. Striping and pavement markings observed to be in good reasonable condition. Striping includes solid double white lines as express lane buffer, yellow shoulder stripe, white skips, and white transition tapers. Pavement markings white directional arrows and white “EXPRESS” designation in each express lane.



*Typical Striping and Lane Marking, Good Condition*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Tolling Devices

Tolling devices were placed on Mono Tube sign as depicted in the attached picture.



*Typical Tolling Device, Good Condition*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Guardrail and Barrier Conditions

Three barrier types were observed adjacent to the express lane: Type 3 Guardrail, TL4 Cable Barrier, and Type 7 Concrete Barrier. The Barriers purpose is to separate travel directions, protect MT Sign installations, and transition to bridge structures. All barriers are in good condition.



*Typical TL4 Barrier, Condition Good*

#### Pavement Condition

Concrete pavement is in good condition. No deficiencies noted.

**3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)**

**Drainage Appurtenances/Shoulder Inlets**

Type C inlets were observed in good condition.



*Typical Shoulder Inlets, Good Condition*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Roadside Elements

##### Vegetation

Median vegetation ranged from good to poor. Observations noted grass established with some weeds, weeds evident, erosion blanket exposed and some minor rills. As a project within the warranty period and landscaping maintenance establishment still being monitored, this is not unusual.



*Typical Median Seeding, Some Growth, Requires Reseeding*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Roadside Delineation and Shouldering

Delineation was in good condition and consistently placed. TL4 Barrier with yellow delineator tabs, shouldering in good shape. This picture represents good vegetation in the median.



*Typical Delineation and Shouldering, with Signing, Good Condition*

### 3.4 West Bound – Toll Zone 2 – Quebec to Broadway (Cont.)

#### Drainage and Median Inlets

Median drainage in good condition, inlets are in good condition with need of trash and debris removal. Concrete low flow channel helps stabilize channel bottom.



*Typical Median Inlet, Requires Debris Cleanup, Inlet Good Condition*

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth

#### Roadway Elements

##### Signing, Striping, and Tolling Devices

###### Signing

All signs were found to be uniform in placement, consistent configuration, and in good condition. There were 3 Mono Tube signs, 8 standard steel post signs.



*Typical Type II Signing, Good Condition*



### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Striping

Striping and pavement markings observed to be in good reasonable condition. Striping includes solid double white lines, yellow shoulder stripe, white skips, and white transition tapers. Pavement markings white directional arrows and white “EXPRESS” designation in each express lane.



*Typical Striping with median vegetation, Good Condition*

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Tolling Devices

Tolling devices were placed on Mono Tube sign and are functioning.



*Typical Tolling Devices, Good Condition*

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Guardrail and Barrier Conditions

Three barrier types were observed adjacent to the express lane: Type 3 Guardrail, TL4 Cable Barrier, and Type 7 Concrete Barrier. The Barriers purpose is to separate travel directions, protect MT Sign installations, and transition to bridge structures. All barriers are in good condition.



*Typical Barrier and Guardrail Transitions, Good Condition*

#### Pavement Condition

Concrete pavement is in good condition. No deficiencies noted.

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Drainage Appurtenances/Shoulder Inlets

Type C inlets were observed in good condition and several only require typical sweeping to remove any sediment and small amounts of debris.



*Typical Median Inlet, Good Condition with only minor sweeping and general maintenance*

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Roadside Elements

##### Vegetation

Median vegetation ranged from good to poor. Observations ranged from grass established with some weeds, weeds evident, erosion blanket exposed and some minor rills. As a project within the warranty period and landscaping maintenance establishment is still being monitored. The observations for this element identified areas that should be reseeded as warranty work with the construction contract.



*Typical Vegetation will need reseeding*

**3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)**

**Roadside Delineation and Shouldering**

Delineation is good condition and located appropriately. No erosion rills were visible within shoulders throughout this segment.



*Typical Shouldering and Delineation, Good Condition*

### 3.5 West Bound – Toll Zone 3 – Broadway to Wadsworth (Cont.)

#### Drainage and Median Inlets

Drainage in fair condition, inlets in good condition with concrete or riprap aprons. Some sediment in the channel bottom but does not significantly affect drainage. Will require periodic maintenance until vegetation growth is established.



*Typical Median, Barrier, and Grading, Good Condition*

### 3.6 Structure Review

All bridges structures were inspected as part of our inspection process for this Engineer's Report. All elements of the structures were inspected for construction defects and damage that may have occurred since project completion. All bridge and structural elements related to the widening of C-470 are in good or new condition. Bridge joints, bridge railing and all substructure elements are also on good condition. The following pictures document our various findings throughout the corridor.

#### Bridges



*WB E470 to WB C470 Flyover, Good Condition*



*Yosemite Overpass, Good Condition*



**3.6 Structure Review (Cont.)**



*Typical Widening University and Broadway, Good Condition*



*Typical Widening, outside, Broadway and Yosemite*

### 3.6 Structure Review (Cont.)



*Acres Green, Slope Paving Cracking, Requires Maintenance*



*Typical Bridge Expansion Joints, All Good Condition*

#### **Sign Structures**

All sign structures were reviewed specifically for any identifiable structure deficiencies. Minor cracking of median concrete is primarily isolated to sign bridge locations at the east end of the facility, just west of I-25. The minor cracking can be repaired and maintenance to the cracking should be done to avoid further deterioration of the median concrete.

### 3.6 Structure Review (Cont.)

Weather and related moisture into the cracked concrete will expand when temperatures drop below freezing. Sign bridge structures where this cracking has occurred are noted below:

- F-17-CC
- F-17-CD
- F-16-EO
- F-16-EC
- F-16-DH

An example of minor cracking of median concrete is shown below.



*Typical Median Barrier Cracking, Requires Maintenance*

**3.6 Structure Review (Cont.)**



*Typical Monotube Overhead Sign, Good Condition*



*Typical Tolling Device appurtenances, Good Condition*

3.6 Structure Review (Cont.)



*Typical Directional Overhead Sign on Monotube, Good Condition*

#### **4.0 Deficiencies and Cost Estimates**

The following sections include the cost estimates for correcting noted deficiencies and are referenced by direction and Toll Zone. These estimates provide a total cost for correcting the noted item and is for information. HPTE should note the associated line-item costs, this may aid in investigating other options to correct deficiencies and have representative costs for reimbursement or negotiations.

## 2021 DEFICENCY ESTIMATE

Independent Cost Estimate  
 HPTE Engineer's Report 2021 - Deficiency Estimate

Item	QTY	Unit	Unit Price	Total Cost	Comment	CDOT Cost Data Book Special Notes	Schedule for Completion
202-04005 Clean Inlet	5	Each	\$1,500.00	\$7,500.00	assumed 5 inlets	Used highest unit bid price for small quantity	Fall 2021 and/or Spring 2022
202-00175 Removal of Concrete	1	LS	\$3,000.00	\$3,000.00	Slope Repair Acres Green	Small Area - limited bid data	Spring 2022
203-01622 Sweeping (w/Pick up broom)	40	Hours	\$215.00	\$8,600.00	5 days for C470 Segment 1, 8 hours per day	Used average award in 2nd quarter	Fall 2021 and/or Spring 2022
212 & 213 Seeding & Mulching	11	Acre	\$2,400.00	\$26,400.00	Assumed 1/2 corridor w/30' depressed median, 1/4 needs reseeding and mulching	Used awarded bid averages for seeding and mulching items	Responsibility of Contractor Spring of 2022
203 - Emb Matl. (CIP)	100	CY	\$65.00	\$6,500.00	Assume 20 CY per base, \$65/CY of embankment	Use of high unit costs due to small quantity.	Spring 2022
519-01000 Epoxy Resin (Injection)	25	LF	\$375.00	\$9,375.00	5 monotube sign bases w/minor cracking	Use of high unit costs due to small quantity (2019 Cost Data)	Spring 2022
601-03000 Concrete Class D	5	CY	\$1,500.00	\$7,500.00	Slope Repair Acres Green	Used highest unit bid price for small quantity	Spring 2022
			\$0.00	\$0.00			
			\$0.00	\$0.00			
630 - Traffic Control Mobile Operation	3	LS	\$2,500.00	\$7,500.00	Three mobilizations due to type of work (crack repair/earthwork/sweeping)		To be used as Needed
<b>Item Sub Total</b>				<b>\$76,375.00</b>			
Contingency (20%)	1	LS	\$15,275.00	\$15,275.00			
<b>Construction Item Total</b>				<b>\$91,650.00</b>			
<b>Design of Construction</b>	10%			\$9,165.00			
<b>CE &amp; Indirects (Construction Items Only)</b>	26.00%			\$23,829.00			
<b>Total Cost</b>				<b>\$124,644.00</b>			



*Example, Inlet Cleaning*



*Example, Sign Base Erosion/Repair*



*Example, Reseeding/Mulching*



*Example, Slope Paving Repair Acres Green*



*Example, Sign Base Crack Repair*



## **Section 5 Six Year Plan of Activities and Estimates**

The focus of the development of the recommended six-year plan for the C470 Express lanes is focusing on maintaining the concrete pavement, striping and markings, and the toll collection infrastructure.

### **Concrete Pavement**

For this new facility the concrete pavement was selected based on the overall life cycle benefits and the expected durability over its 40-year design life. Preventative maintenance of the concrete pavement should be a focus to extend the service life and reduce the overall costs to maintain the concrete pavement. Typically, within the first four to seven years, based on previous SHRP studies conducted on concrete pavements, the types of maintenance activities that should be planned for include joint and crack sealing and spall repairs. Inspecting, cleaning, and sealing any joints or cracks that may have separated will protect moisture from penetrating to the subbase and the problems that result from freeze thaw or the weakening of the base. A pavement that is wearing well should receive a high priority for crack sealing.

Spalls or corners that break or crack between panels should be another high priority for repairs. Typically spalls will not affect the condition of the remaining panel and if repaired in a timely manner will prevent future and additional damage from occurring within the spalled panel and adjacent panels. Crack, joint and spall repairs can be conducted by maintenance crews and would not have to be completed as part of separate construction contract. Timely repairs of these types of items will also preserve the overall pavement smoothness and overall pavement rideability.

### **Striping and Markings**

The current inlaid epoxy striping material should have a three-to-five-year life span depending on weather and other conditions. Based on this cycle HPTE should plan to restripe the express lanes within this six-year time frame. Other express lane markings may not need replacement but for planning purposes this estimate and recommendation has included all lane markings.

### **Toll Collection Devices**

The toll collection devices and appurtences are most likely going to need replacement within this six-year time frame. The replacement may be needed due to wear and tear but also to account for changing and new technology that will be implemented, used, and standardized for this and other express lanes in Colorado.

C470 Express Lane - Six-Year Plan of Investments

	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	Comments
<b>Activity/Project</b>							
<b>Express Lane Striping Refresh</b>							
- Edge/Buffer/Channelizing (Inlaid Epoxy)			\$ 435,000			\$ 490,000	Based on a 3-year pavement marking life span and typical refresh cycle
- Traffic Symbols (Preformed Inlaid)			\$ 160,000			\$ 180,000	Based on a 3-year life/ Symbols may have longer life/worse case assumed
<b>Concrete Pavement Preventative Maintenance</b>							
- Crack and Joint Sealing					\$ 126,000	\$ 131,000	Based on 2500 Linear Feet/year
- Spall Slab Repair					\$ 75,000	\$ 78,000	Based on 50 slab repairs (3'x3' Typical)
<b>Toll Collection Equipment</b>							
- Cameras, License Plate Readers, Misc.	\$ 4,100,000						
<b>Fiscal Year Totals</b>	\$ 4,100,000	\$ -	\$ 595,000	\$ -	\$ 201,000	\$ 879,000	